

Advanced Simulation Framework for Design and Analysis of Space Propulsion Systems, Phase I

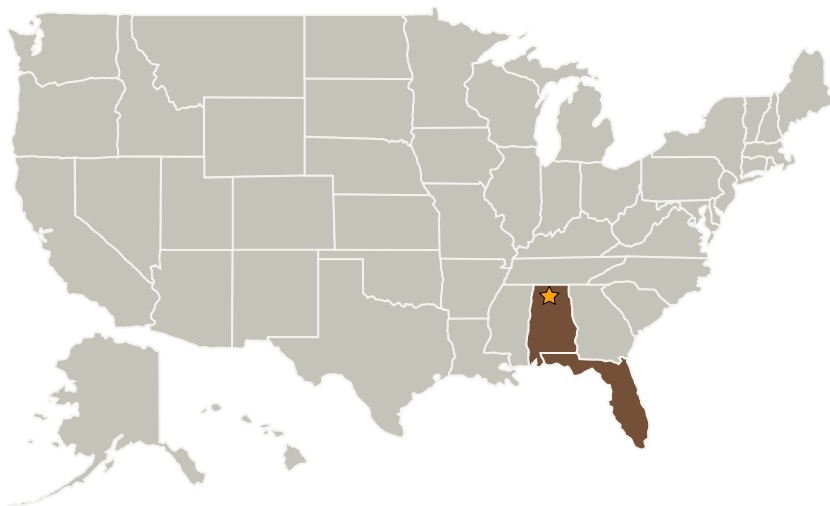
Completed Technology Project (2009 - 2010)



Project Introduction

The innovation proposed here is a computational framework for high performance, high fidelity computational fluid dynamics (CFD) to enable accurate, fast and robust simulation of unsteady turbulent, reacting or non-reacting flows involving real or ideal fluids in several applications. This framework will provide a state-of-the-art unsteady turbulent flow simulation capability employing Hybrid RANS-LES (HRLES) methods which are a blend of Reynolds Averaged Navier-Stokes (RANS) and Large Eddy Simulation (LES) approaches. Low-dissipation schemes will be employed which will enable high-fidelity modeling of unsteady flows as well as acoustic fields. Additionally, Lagrangian particle tracking and Eulerian multiphase models will be incorporated to enable simulation of multiphase combustion involving solid particles or liquid droplets. The work proposed here will result in a state-of-the-art design and analysis tool to enable the accurate modeling of: (a) multiphase combustion in solid and liquid rocket engines, (b) combustion stability analysis (c) acoustic fields of space propulsion systems in near-ground operation, (d) small valves and turbopumps, etc. which constitute critical components of versatile space propulsion engines part of NASA's Constellation Program.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Streamline Numerics, Inc.	Supporting Organization	Industry	Gainesville, Florida

Primary U.S. Work Locations

Alabama	Florida
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Project Transitions

**January 2009:** Project Start**January 2010:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Siddharth Thakur

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.4 Vehicle Systems
 - └ TX09.4.5 Modeling and Simulation for EDL